Review of Methods for and Impacts of Raw Milk Disposal

Prepared for

Gas Industry Company Ltd

Prepared by

LWE Environmental Impact

October 2012

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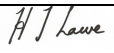
Approved for Issue by:	Hamish Lowe	
Status:	Final (revised)	

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Job No.: 10088
Date: October 2012
Ref: RE - 10088 - GIL - Milk Plant Outage Report - 121003 - revised final.doc

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1.0 EXECUTIVE SUMMARY

There is a range of possible scenarios where milk from dairy farms will be unable to be collected and processed, leading to the need for farmers to dispose of milk. These scenarios include floods, earthquakes, electric power supply failure, and industrial action. One of these scenarios is a disruption to the supply of gas fuel to dairy processing plants in the North Island, as a result of which large numbers of dairy farmers may be obliged to dispose of the milk they continue to produce until such time as their processing plant can resume operation. This report is to address the potential environmental consequences of such a disruption to the supply of gas fuel.

Dairy farms generally only have one day's milk storage capacity, so any disruption to the operation of dairy processing plants for longer than a day or so should be expected to lead to a requirement for farmers to dispose of milk. Such disruptions on a wide scale have been few and far between, and while the milk processing companies and regional councils have various contingency plans in place, in practice many dairy farmers have never had to dispose of milk.

The environmental consequences of large scale milk disposal are a cumulative threat to water quality, and the cumulative generation of offensive odours. For both water quality and odour, the cumulative result is greater than the sum of the individual on-farm events.

The direct or indirect disposal of milk to a water body could result in significant environmental damage; and such a discharge would be unlawful under the Resource Management Act. However, there are other options for milk disposal, and dairy companies and regional councils publish information on these. This report assesses these options and their implications.

It would be prudent for dairy farmers and dairy companies alike to assess the risks they face in regard to milk disposal, and to make appropriate preparations for their management.

Information on the location and quantification of milk production has been sourced from DairyNZ, and tabulated in this report. There are nearly 9,000 dairy farms in the North Island, with an average area of 140 ha, an average sized herd of 386 cows, and an average milk production of 5.5 m^3/d for a 270 day milking season each year. The tabulation of DairyNZ data provides an insight to where geographically this milk is produced.

The available options for milk disposal are considered in this report, and can be summarised as follows.

- Discharge to water is not an option, due to serious ecological damage.
- Sending the milk somewhere other than the usual processing plant is only an option to the extent that individual farmers may be able to find a taker for their milk. Dairy companies may be relied upon to redirect milk to other plants unaffected by a plant outage, to the extent that available processing capacity and transport is available.
- Feeding the milk back to the cows is considered unlikely to prove an effective method of disposing of large volumes of surplus milk.
- Burial of milk is possible, subject to the burial site being suitable in terms of both potential leakage to water bodies and ability to effectively prevent surface ponding.
- Discharge of milk into the farm's effluent system is the most practicable option for most farmers, and can be satisfactory provided the requirement for the discharge does not

last longer than 4 to 6 milkings. After this time, odours become serious, and discharge from the effluent system to water or to land will damage the receiving environment.

- Irrigation of diluted milk onto pasture can be undertaken over a long term without adverse environmental effects, provided certain limits are adhered to and provided the necessary infrastructure is available. Prolonged application of milk to pastures can damage soil function and pastoral production; for this reason the milk needs to be diluted, and not re-applied to the same site for at least 20 days.

The dependency of the North Island's significant milk processing plants on gas fuel is tabulated in this report. Available information indicates that most plants depend on gas for some of their operation, and many are entirely dependent on gas.

The Resource Management Act provides for the regulation by regional councils of discharges into the environment; the provisions of the Act that are relevant to milk disposal are quoted in the report. Milk disposal by discharge is nominally a discharge of contaminant into the environment, and as such is an activity falling under the regulatory control of regional councils. North Island regional councils all provide advisory and promotional support to farmers caught with a requirement to dispose of milk, and do not impose a requirement for specific resource consents or reporting for milk applications during emergency conditions. Section 341 of the Act is accepted by many councils as a defence against prosecution for a farmer discharging milk who is diligently following the available promotional advice. Under current practice, North Island regional councils do not look for resource consent applications or reporting for the type of large scale milk disposal that would be caused by a gas supply outage. Their approach is instead one of support and advice to minimise environmental damage to the extent that is practicable in the circumstances.

In conclusion, any wide-spread requirement to discharge milk has the potential to create significant pollution of water, damage to soil, and release of odours. However, there is a range of milk disposal options available to farmers to reduce the environmental effects to levels that may be considered acceptable. Discharge of milk to the farm effluent system is a practicable option on most farms, although problems can arise if the discharge has to continue for longer than about 4 to 6 milkings, especially if the farm dairy effluent is then discharged to water. Irrigation of the milk to pasture can be sustained over a long period, although many farms will not have the infrastructure available to use this option, especially when significant water additions are required and limited advance warning is provided.

Gas outages lasting longer than 3 or 4 days have the potential to result in unacceptable environmental impacts as a result of milk discharge. This will be particularly the case if outages occur at the peak of a milking season, when both farm effluent systems and alternative processing plants will be at full capacity. Irrigation systems (clean water and farm dairy effluent) should be able to avoid environmental damage, and most farm systems will cope with short term outages of a few days at the most. However, a large number of farms are likely to run into environmental problems if outages last longer than 3 or 4 days, especially where necessary infrastructure cannot be quickly adapted or waterway discharges are used for managing farm dairy effluent.

2.0 INTRODUCTION

2.1 Background

Natural gas is supplied to industry and private connections throughout the North Island. Gas Industry Company Ltd (GICL) is the gas industry body, responsible for developing industry arrangements that ensure gas is delivered safely, efficiently and reliably to new and existing customers.

A rupture on the Maui pipeline in October 2011 led to a six-day critical contingency and curtailment of natural gas supply to consumers in Waikato, Auckland, Northland, and the Bay of Plenty. Included in the curtailment were most of Fonterra's manufacturing plants, and at least one independent processor, in those regions. Without manufacturing capability, neither Fonterra nor the dairy farmers supplying Fonterra were able to process or to store the raw milk being produced, and so farmers had to resort to disposing of the milk on their farms.

GICL is conducting a review of the events during the Maui outage and the effectiveness of the regulations underpinning the critical contingency regime (Gas Governance (Critical Contingency Management) Regulations 2008). One of the findings to emerge from the review is that the criteria for designating essential service providers (those gas users who have priority access to gas during a contingency) are broad and open to interpretation. One of the options GICL is considering is tightening and clarifying the criteria for such designations. This may impact on the security of access to gas supplies by industry, including milk processing facilities.

Lowe Environmental Impact (LEI) has prepared this report for GICL in line with a terms of reference document, (attached as Appendix 1) which sets out the need to evaluate the impact of gas outages on milk processing, and in particular, the impact of discharging raw milk.

2.2 Scope

This report follows the format, and addresses the issues, specified in the LEI proposal to GICL dated 14 June 2012, and accepted by GICL in its letter of 15 June 2012.

The report addresses issues relating to the disposal of raw milk in the North Island of New Zealand under the following headings:

- Quantification and localisation of milk production.
- Assessment of dependency on gas.
- Current processing and farm contingency measures.
- RMA regulatory requirements.
- Environmental effects of discharging raw milk.
- Critically dependent timing and effects.

The report is an overview, making use of and summarising information currently available from a variety of sources. Sources of information are acknowledged in the report.

There is significantly more detailed information, which is relevant to the subject of this report, and which is available, than has been incorporated into this report. The intention has been to provide a high-level overview of the issues involved, for the purpose of policy evaluation, rather than the level of detail that would be required for operational planning and management.

3.0 QUANTIFICATION AND LOCALISATION OF MILK PRODUCTION

3.1 Introduction

Raw milk is produced on dairy farms in every region of the North Island. Most milk is produced during a 270 day season each year, typically running from late August through to early May. Milk is normally collected from a storage vat close to the milking shed by a road tanker every day, and transported to a milk processing plant.

To determine the potential for an adverse environmental impact due to the discharge of milk it is appropriate first to assess the scale of the potential impact with regard to the amount of milk produced.

The information on milk quantities and source locations used in this report is taken from "New Zealand Dairy Statistics 2010-11", (DairyNZ 2011), compiled and owned by DairyNZ. The copyright for these statistics is owned by DairyNZ, and LEI has requested and received the written approval of DairyNZ for its use in this report.

The regions used by DairyNZ for its statistics do not exactly align with local government boundaries, so data held by some regional councils differs from that held by DairyNZ. This report uses the DairyNZ data unaltered because of its national consistency and the length of the record. The 2010-11 period is the most recent for which the information is available.

3.2 Milk Production by Regions - Data

Table 1 below compiles information from DairyNZ (2011) to show the annual quantity and location of milk production. Explanations of details of Table 1 are as follows:

- Farming Region, as shown in the first column, is the regional breakdown used by DairyNZ and its predecessors since 1974. This breakdown is equivalent to regional council regions in some areas, but not in others.
- Local government districts, as shown in the second column, are as used by DairyNZ, and align with current local government boundaries, with the exception of Auckland, where the four districts with dairy farming activity were amalgamated with the regional council in 2010.
- Regional council areas, as listed in the third column, have been recorded by LEI against their current constituent districts, which differ from DairyNZ's regions in some instances.
- Number of herds, and number of cows, in the fourth and fifth columns respectively, are taken directly from DairyNZ (2011), where they are listed in Table 3.3. These are the numbers of herds and cows milked during the 2010-11 milking year.
- Average production in litres per herd, in the sixth column of Table 1, is taken directly from DairyNZ (2011), where it is listed in Table 3.4. This is annual production in the 2010-11 milking year.
- Milk production total for the 2010-11 milking year, in the seventh column of Table 1, is recorded in millions of litres (i.e. thousands of cubic metres). It is compiled by LEI from

the number of herds in the fourth column and the average production in litres per herd in the sixth column.

- Estimated Average Daily Milk Production, in the eighth column of Table 1, is recorded in millions of litres (ie thousands of cubic metres). It is compiled by LEI from the annual total milk production for 2010-11 in column 7, divided by the 270 days of the typical annual milking season. It is noted that there is seasonal variation in the daily milk production such that a flush of milk occurs early in the season, and tapers off as the season progresses. Herds typically average 20 L/cow/d between August and November, tapering off to about 12 L/cow/d in April (DairyNZ (2011), Table 4.5). Accordingly, actual daily milk production will be the average figure listed in column 8, multiplied by a factor of 1.4 during the spring, but multiplied by a factor of 0.85 in later autumn. However, an average daily milk production is considered to be a sound basis for the conclusions drawn in this document.

Table 1: Milk Production by Region and District, 2010-11

Farming Region (DNZ)	Local Govt District (DNZ)	Regional Council (LEI)	Number of Herds (DNZ)	Number of Cows (DNZ)	Ave Production, L/herd 2010-11 (DNZ)	Annual Total Milk Production, 2010-11, Million Litres (LEI)	Estimated Average Daily Milk Production, Million Litres (LEI)
Northland	Far North	Northland	261	71,986	903,187	235.7	0.87
	Whangarei	Northland	308	98,048	1,078,668	332.2	1.23
	Kaipara	Northland	361	105,036	963,595	347.9	1.29
Regional Subtotal			**930**	**275,070**		**915.8**	**3.39**
Auckland	Rodney	Auckland	164	43,457	857,608	140.6	0.52
	Manukau	Auckland	14	3,030	784,166	11.0	0.04
	Papakura	Auckland	5	762	533,835	2.7	0.01
	Franklin	Auckland	263	63,470	895,572	235.5	0.87
Regional Subtotal			**446**	**110,719**		**389.8**	**1.44**
Waikato	Waikato	Waikato	679	218,610	1,172,329	796.0	2.95
	Hamilton	Waikato	18	4,488	954,151	17.2	0.06
	Waipa	Waikato	586	197,483	1,264,675	741.1	2.74
	Otorohanga	Waikato	381	135,073	1,277,904	486.9	1.80
	Thames-Coromandel	Waikato	86	24,563	1,088,815	93.6	0.35
	Hauraki	Waikato	412	113,419	1,004,222	413.7	1.53
	Matamata-Piako	Waikato	1,016	296,992	1,095,140	1,112.7	4.12
	South Waikato	Waikato	388	144,651	1,478,192	573.5	2.12
Regional Subtotal			**3,566**	**1,135,279**		**4,234.7**	**15.68**

Farming Region (DNZ)	Local Govt District (DNZ)	Regional Council (LEI)	Number of Herds (DNZ)	Number of Cows (DNZ)	Ave Production, L/herd 2010-11 (DNZ)	Annual Total Milk Production, 2010-11, Million Litres (LEI)	Estimated Average Daily Milk Production, Million Litres (LEI)
Bay of Plenty	Western BOP	Bay of Plenty	200	67,512	1,184,712	236.9	0.88
	Tauranga	BOP	14	4,039	861,969	12.1	0.04
	Kawerau-Whakatane	BOP	308	95,916	1,187,916	365.9	1.36
	Opotiki	BOP	78	24,571	1,054,544	82.3	0.30
Regional Subtotal			**600**	**192,038**		**697.2**	**2.58**
Central Plateau	Taupo	Waikato	144	102,741	2,601,238	374.6	1.39
	Rotorua	Bay of Plenty	316	133,907	1,589,961	502.4	1.86
Regional Subtotal			**460**	**236,648**		**877.0**	**3.25**
Western Uplands	Waitomo	Waikato	58	28,229	1,480,124	85.8	0.32
	Ruapehu	Horizons	25	11,538	1,505,443	37.6	0.14
Regional Subtotal			**83**	**39,767**		**123.4**	**0.46**
East Coast	Gisborne/Wairoa	Gisborne; Hawkes Bay	9	4,742	1,381,693	12.4	0.05
Regional Subtotal			**9**	**4,742**		**12.4**	**0.05**

Farming Region (DNZ)	Local Govt District (DNZ)	Regional Council (LEI)	Number of Herds (DNZ)	Number of Cows (DNZ)	Ave Production, L/herd 2010-11 (DNZ)	Annual Total Milk Production, 2010-11, Million Litres (LEI)	Estimated Average Daily Milk Production, Million Litres (LEI)
Hawke's Bay	Napier, Hastings	Hawke's Bay	32	19,115	2,103,182	67.3	0.25
	Central Hawke's Bay	Hawke's Bay	39	27,517	2,647,317	103.2	0.38
Regional Subtotal			**71**	**46,632**		**170.5**	**0.63**
Taranaki	New Plymouth	Taranaki	437	110,088	898,352	392.6	1.45
	Stratford	Taranaki	249	60,322	900,028	224.1	0.83
	South Taranaki	Taranaki	1,058	316,505	1,103,093	1,167.1	4.32
Regional Subtotal			**1,744**	**486,915**		**1,783.8**	**6.61**
Manawatu	Whanganui	Horizons	22	8,927	1,306,692	28.7	0.11
	Rangitikei	Horizons	93	39,967	1,693,777	157.5	0.58
	Manawatu	Horizons	258	93,160	1,362,707	351.6	1.30
	Palmerston North	Horizons	53	18,587	1,350,721	71.6	0.27
	Horowhenua	Horizons	120	46,474	1,546,221	185.5	0.69
	Kapiti Coast/Upper Hutt	Wellington	22	6,050	1,058,532	23.3	0.09
Regional Subtotal			**568**	**213,165**		**818.2**	**3.03**

Farming Region (DNZ)	Local Govt District (DNZ)	Regional Council (LEI)	Number of Herds (DNZ)	Number of Cows (DNZ)	Ave Production, L/herd 2010-11 (DNZ)	Annual Total Milk Production, 2010-11, Million Litres (LEI)	Estimated Average Daily Milk Production, Million Litres (LEI)
Wairarapa	Tararua	Horizons	312	99,288	1,110,180	346.4	1.28
	Masterton	Wellington	18	7,847	1,878,303	33.8	0.13
	Carterton	Wellington	56	20,524	1,352,050	75.7	0.28
	South Wairarapa	Wellington	84	37,061	1,599,529	134.4	0.50
Regional Subtotal			**470**	**164,720**		**590.3**	**2.19**
North Island Total			**8,947**	**2,905,695**		**10,613.1**	**39.31**

3.3 Milk Production by Regions – Issues and Interpretation

3.3.1 Daily Production

Over the whole 2010-11 milking season, the North Island produced 10,600 million litres (ie 10.6 million cubic metres) of raw milk.

While there is a variation in the amount of milk produced each day as the season progresses, and while there is a limited amount of milk produced for domestic supply during the winter, the great majority of milk is produced during a 270 day season each year, between August and May. Accordingly, from each annual total of milk production listed in column 7 of Table 1 above, a daily volume for each day during the milking season is approximated by dividing the annual total by 270, with daily totals shown in column 8 of Table 1.

Thus the whole North Island produced in 2010-11 about 39,300 cubic metres of milk each milking day, noting that this volume can vary between 85% in April to 140% in spring. Similarly, for examples, the Northland region can be calculated to have produced about 3,400 m^3/d, and the Otorohanga District about 1,800 m^3/d. These may be considered to reasonably approximate the quantities of raw milk that would need to be disposed of, in each affected district and region, for every day that a gas supply outage (or any other equivalent disruption) prevents milk processing plants from uplifting milk from farms.

The figures in Table 1 relate to the farms where the raw milk is produced. They do not directly reflect the locations of the dairy processing plants at which the possibility of a gas supply disruption may force contributing farmers to dispose of milk.

3.3.2 Recent and Future Production Trends

For the whole of New Zealand, the total quantity of milk processed in each milking year has increased from 5.8 billion litres (5.8 million m^3) in 1976-77 to 17.3 million m^3 in 2010-11 (DairyNZ 2011, Table 2.1), a three-fold increase over a 35 year period.

In the more recent 10 years between 2001-02 and 2010-11 inclusive, the total quantity of milk processed per year increased from 13.6 to 17.3 million m^3, a 27% increase overall and an average annual increase of slightly over 2%. It is reasonable to expect future growth of production to continue at about this rate for at least the next several years.

The following key statistics are also relevant to the consideration of likely short to medium term future trends in dairy production.

- The number of dairy herds in New Zealand as a whole has declined from 15,821 in 1981-82 to 11,735 in 2010-11 (DairyNZ 2011, Table 2.2). This decline is the net result of farm closures and amalgamations, partly offset by new conversions to dairying from other types of farming.
- Over this same interval, the number of cows throughout New Zealand has more than doubled, from 2.06 million in 1981-82 to 4.53 million in 2010-11 (DairyNZ 2011, Table 2.2).

- The area of land used for dairy farming throughout New Zealand has increased from a little under 1 million ha in 1981-82 to nearly 1.64 million ha in 2010-11 (DairyNZ 2011, Table 2.2). Land for dairy production is used more efficiently than in the past, carrying an average of between 2.7 and 2.8 cows/ha since 2003-04, compared with 2.1 to 2.3 cows/ha between 1982-83 and 1986-87.
- The national average herd size has increased from 130 in 1981-82 to 386 in 2010-11 (DairyNZ 2011, Table 2.2), an almost 3-fold increase over the 30 year interval.

It may reasonably be expected that over the next several years, annual (and therefore also daily) total milk production in the North Island will continue to increase by about 2% per year. This may be expected to be driven by continuous improvements to herd genetics, improved efficiency of pasture management, and increases in both total cow numbers and the area of land committed to dairy farming.

Changes in milk production in individual districts and regions are more difficult to predict, but significant increases in the area of land committed to dairying (and therefore of milk production) are possible in such districts as Masterton, Carterton, Central Hawke's Bay and Rangitikei, if major irrigation initiatives which are currently at the conceptual stage reach fruition.

3.3.3 Specific Conclusions

Direct responses to the questions posed in Item 5 of the Terms of Reference (Appendix 1) are as follows:

- Milk production in a typical year, by week and by region, can be calculated as required from Table 1 above. The breakdown provided is by district as well as by region for better precision, and by day rather than by week to enable a more precise estimate of the implications of any actual milk disposal requirement.
- The amount of milk that could feasibly be disposed of on farms in a peak week will be the district or farm average daily milk production, multiplied by a factor of 1.4 for the peak productivity, multiplied by 7 days. The volume to be managed on each farm will be a direct function of the size of the herd, which ranges from a few dozen to several thousand cows. The land area on each farm will also be a direct function of herd size. While a farm with a large herd will have more milk to manage, it will also have a proportionately larger area of land on which to manage milk disposal, although not all that land will necessarily be set up with infrastructural capacity to handle any more than the peak effluent load.

4.0 ASSESSMENT OF DEPENDENCY ON GAS

4.2 Data Collection and Limitations

A review of the major milk processing plants in the North Island was carried out using various source materials to establish the location and capacity of the plants. The resulting information was put into tabular format for ease of use.

Information was sourced from processor websites and direct contact (phone, email) with relevant processor staff. The main limitation when collecting information was commercial sensitivity surrounding data collection (such as gas usage, site processing capacity).

There were some smaller boutique cheese producers identified in the North Island. However, their operations are on a much smaller scale than the main milk processors, so they were not included in this assessment.

4.3 Plant Gas Use Data

Table 2 below lists the current milk processing plants identified in the North Island, against their product mix and gas fuel dependency.

Table 2: North Island Milk Processing Sites – Gas Dependency Details

Key: AMF = anhydrous milk fat: WPC = whey protein concentrate

Site Name	Location	Products	Is gas used on site?	Gas Uses
Fonterra Sites				
Kauri	Northland	Butter, milk powders, conc. milk fat	Yes	Thermal – generating steam, hot water Air heating – for use in product drying
Maungaturoto	Northland	Whole milk powder, whey powders, nutritional powders, casein	Yes	Thermal – generating steam, hot water Air heating – for use in product drying
Te Awamutu	King Country	Milk powders, butter, AMF products	Yes (one boiler only; their other boiler fuelled with coal)	Thermal – generating steam, hot water Air heating – for use in product drying
Te Rapa	Waikato	Milk powders, cream products (butter, cream cheese, AMF)	Yes	Thermal – generating steam, hot water Air heating – for use in product drying Co-generation activities
Hautapu	Waikato	Cheese, lactose products, casein, milk protein products, whey protein products	Yes (in combination with coal – proportions unknown)	Thermal – generating steam, hot water Air heating – for use in product drying
Morrinsville	Waikato	Milk powders, butter	Yes	Thermal – generating steam, hot water Air heating – for use in product drying
Lichfield	Waikato	Speciality cheeses, whey protein concentrate + isolates	Yes	Thermal – generating steam, hot water Air heating – for use in product drying
Tirau	Waikato	Ethanol, casein products, acid casein, lactalbumin	Yes	Thermal – generating steam, hot water Air heating – for use in product drying
Reporoa	Waikato/BOP	Food-grade ethanol, protein products	Yes	Thermal – generating steam, hot water Air heating – for use in product drying
Waitoa	Waikato	Milk powders, nutritional products	No, coal used as fuel	Not specified

Site Name	Location	Products	Is gas used on site?	Gas Uses
Edgecumbe	BOP	Ethanol, whey products, protein products, butter, casein, lactose concentrate, AMF	Yes	Thermal – generating steam, hot water Air heating – for use in product drying Co-generation activities
Eltham	Taranaki	Cheeses	Yes	Thermal – generating steam, hot water
Kapuni	Taranaki	Lactose products	Yes	Thermal – generating steam, hot water Air heating – for use in product drying Co-generation activities
Whareroa	Taranaki	Milk powders, cheese, butter	Yes	Thermal – generating steam, hot water Air heating – for use in product drying Co-generation activities
Pahiatua	Manawatu	Milk powders	Yes	Thermal – generating steam, hot water Air heating – for use in product drying
Longburn	Manawatu	Milk collection for transport to Whareroa site; mineral acid casein	Yes	Thermal – generating steam, hot water Air heating – for use in product drying
Te Roto	Kapiti Coast	Speciality cheeses	Yes	Thermal – generating steam, hot water
Independent Milk Processing Sites				
Tatuanui (Tatua Coop)	Waikato	Speciality cream products, specialised protein & whey products	Yes	Thermal – generating steam, hot water Air heating – for use in product drying Use in sterilizer unit (can sterilising) Usage split - 60% steam generation, 40% driers
Open Country Dairy Wanganui	Whanganui	Whole milk powders	Yes	Thermal – generating steam, hot water Air heating – for use in product drying
Open Country Dairy Waharoa	Waikato	Cheese, milk powders, WPC, AMF	Partly	Not known – assumed to be similar to Wanganui (thermal – generating steam, hot water; air heating – for use in product drying)
Miraka Mokai	Taupo	Milk powders	Bottled only	Forklift fuel only

In addition to the milk processing sites tabulated in Table 2, fresh milk for domestic use is processed at two main sites in the North Island. Fonterra operates one plant at Takanini (Auckland), and Goodman Fielder operates the other at Longburn (Palmerston North). Each of these sites uses gas fuel for its operation. These two plants between them produce over 90% of North Island domestic milk consumption. There are also several smaller local or regional operators, whose volume of throughput and dependency on gas fuel has not been ascertained.

4.3 Implications of Data

Points of note are as follows:

- The majority of milk processing sites are Fonterra-owned sites;
- There are only a few independent milk processing sites. They are generally smaller scale, compared with the overall scale of Fonterra's operations in the North Island;
- Milk processing in the North Island is heavily reliant on natural gas as a fuel for on-site operations; and
- There is some use of other fuels (coal) on individual sites. Sites that use coal are noted in Table 2.
- By far most bottled milk for the North Island domestic market mostly comes from one plant near Auckland, and one plant at Palmerston North.

5.0 CURRENT PROCESSING AND FARM CONTINGENCY MEASURES

5.1 Processing Contingency Measures

Information on the milk processing industry's arrangements for the disposal of raw milk at processing sites has been requested from Fonterra. The requested information had not been received by the time this report was released to GICL.

5.2 Farm Contingency Measures

If a tanker is unable to collect milk from a dairy farm for any reason, including a gas supply outage stopping the operation of the farm's milk processing plant, then the farmer will need to make arrangements for the alternative disposal of the milk that s/he has on hand. S/he will also need to continue to dispose of milk which continues to be harvested every day until the tanker can resume its normal daily collection. Dairy farms have limited milk storage capacity, normally only sufficient for one day's production, which is consistent with the tanker collecting the milk daily. During the shoulders of the season, being early spring and later autumn, collection may be every second day providing adequate refrigeration can be provided at that farm.

The milking of cows cannot be randomly started and stopped once lactation has started. Once a season's milking begins, normally in August, milking must continue daily until the normal end of the season in May. If necessary, and possibly with a requirement for veterinary assistance, lactation can be slowed or stopped at any time, but it cannot be started again until after the birth of a new calf.

Milking can be slowed, for example by reducing from two milkings to one milking per day, and this could be expected to reduce the daily volume of milk to be disposed of by up to 30%. There would be animal health and welfare issues to contend with, and a return to full milking could be delayed. Slowing milk harvesting potential allows for managing environmental effects with the trade-off of animal welfare and financial difficulties.

With a short term disruption to milk collection, a farmer should be able to manage alternative disposal of her/his milk with an acceptable degree of inconvenience. But a disruption to milk collection which is for a longer term could necessitate the drying-off of the herds involved. However, a consequence would be that there would be no further milk from those herds until the following August. The economic consequences of this happening, particularly if it is early in a milking season, and within a large area involving perhaps several districts or even whole regions, would be extremely serious both within and beyond the area directly involved.

The average quantity of milk to be managed on an average farm based on the current national averages would be 5,474 L/d, or 5.5 m^3/d. This average daily milk volume will vary through the season, from a maximum of 7.7 m^3/d in spring, down to a minimum of 4.7 m^3/d in later autumn. Options for the management of this milk are described below.

5.2.1 Option 1 – Send the Milk Somewhere Else

Explanation: The milk could be sent to another processing plant, or to a piggery etc.

Advantages: The milk would not need to be discharged. It would be put to an alternative productive use, with no adverse environmental consequences. The farmer could receive payment for milk.

Disadvantages: There is little or no "spot market" for milk, especially when each farmer has to dispose of an average of 5 m^3/day. Other milk processing plants, and piggeries, can only operate profitably by minimising redundancies in capacity. They will have made arrangements to receive the supplies they need, and should be expected to have little or no capacity to receive a sudden, unplanned extra supply. While individual farmers may be successful in finding an alternative market for their milk, it is considered highly unlikely that this will provide a satisfactory alternative to discharge for most farmers.

Limits: The limiting factors here are the ability to find somewhere else to send the milk, and finding the means by which to send it.

Obligations: Because the milk would be sold rather than discharged, there should be no legal impediments to a farmer taking this approach, unless her/his supply agreement with her/his dairy company prevents it, and unless there are Food Safety Authority considerations that may not be able to be met. There would be no regional council involvement in this option.

Promotional: Farmers are entitled to expect that their processing plant will use its best endeavours to find any available opportunities for continuing milk production to be taken. In this regard, during the disruption to the fuel supply in 2011, Fonterra set up a rotational pick-up system and took milk to functioning plants elsewhere. This meant that many farmers in affected areas had milk collected one or two days out of three, significantly decreasing the burden on each farm. Otherwise, finding an alternative market for some or all of the term of the outage will depend on the individual farmer's initiative.

Conclusion: This is the best option for the few farmers who may be able to arrange it, but unlikely to be an option practically available to most. Dairy companies can be depended upon to re-route milk to operational plants to the extent that this is feasible.

5.2.2 Option 2 – Discharge the Milk to a Waterway

Explanation: The milk would be tipped from farm storage into the nearest stream.

Advantages: Quick and easy, no on-site odour, no on-farm mess to manage.

Disadvantages: Serious ecological damage to the receiving waters. Farmer should expect to be prosecuted by the regional council if he is caught as the material has the potential to result in significant environmental damage. Councils are using "Eye in the sky" surveillance more frequently and if used in the event of a significant plant outage it would make the risk of detection high. Further, the potential effect on surface water is very significant and observations and current monitoring programmes would likely lead to identifying the source.

Limits: The limiting factor here is the fact that such a discharge would be unlawful.

Obligations: No regional council allows an unauthorised discharge of milk to a water body as a permitted or controlled activity. No regional council is likely to grant a consent to discharge milk

to a water body. Such a discharge, if correctly detected and reported, would likely result in a prosecution.

Promotional: The promotional and advisory information available from all North Island regional councils, whether it is policy material, hand-out brochures, *ad hoc* print or broadcast material released in response to a particular event, all highlights the requirement for milk not to be discharged into a waterway, or onto land in such a way that it may get into a waterway.

Conclusion: The discharge of milk to water is not an option, in any circumstances due to the adverse environmental effects that may result.

5.2.3 Option 3 – Feed the Milk to Livestock

Explanation: Milk from the farm storage facility is placed in troughs where cows can drink it.

Advantages: Every litre that gets drunk is another litre that does not have to be otherwise disposed of. Provided the cows actually drink it, this method reduces the surplus to be disposed of.

Disadvantages: While all milking cows were once calves and brought up on milk, adult cows are not used to drinking milk, either behaviourally or physiologically. Brief discussion with dairy farmers shows little or no experience in getting adult cows to drink milk. The troughs or similar feeding infrastructure, and the means of getting milk into them, will not necessarily be available on farms. Troughs will need to be cleansed of surplus daily in order to avoid decay, off flavours, and odour. It is considered unlikely that most cows would drink much milk, let alone as much milk as they produce each day, so there would still be a surplus to dispose of.

Limits: The limiting factor here is the extent to which cows will drink milk.

Obligations: No consenting or other legal impediments. Breaks no laws, needs no approvals.

Promotional: This option is promoted in the advisory information provided by several regional councils.

Conclusion: On the face of it this appears to be a good option, but in practice it depends on whether or not the cows will drink the milk. Would involve considerable labour, and would require suitable infrastructure, but may make little or no difference to the quantity of milk still needing to be disposed of.

5.2.4 Option 4 – Irrigate the Milk onto Pasture

Explanation: The milk is watered down and irrigated onto pasture. This can be applied using any of several methods, including:

- Clean water irrigation infrastructure, such as centre pivot or pipe and impact sprinkler systems;
- Effluent irrigation infrastructure, such as travelling irrigators or K-Line type systems;
- Effluent spreading wagons ("Honey wagons"); and
- Agricultural spraying equipment.

Advantages: Can avoid contamination of waterways or groundwater by applying at recommended rates, away from waterways. May assist pasture growth. Enables disposal of surplus milk. One light pass of the irrigator with diluted milk should not compromise the quality or productivity of the soil, and nor should it give rise to offensive and objectionable odours.

Many dairy farms in drier districts have clean-water irrigation systems in place. Most dairy farms in most regions have the infrastructure set up to irrigate farm dairy effluent onto land. Some of these systems may quickly be adapted to apply diluted milk, if and when the need arises.

Disadvantages: The main disadvantage is that many dairy farms do not have irrigation infrastructure, or ready access to mobile equipment that could suffice. About half the dairy farms in Taranaki and Northland, and about 10% of those in Waikato, still discharge their more-or-less treated farm dairy effluent to waterways. Most of the 1,700 farms in this situation, representing nearly 20% of all North Island herds, will not have the infrastructure in place to apply this option; being they have neither clean water irrigation systems nor effluent irrigation systems. Some clean water irrigation systems, such as centre pivots, may not cope with the clotting solids content in milk. Even where the land and the irrigation system are suitable, the physical infrastructure to mix the milk with the appropriate volume of water and feed it into the irrigation system may not be in place, at least in the case where a quick discharge solution is needed. Contractors and some farmers will have honey wagons or similar that could be very suitable, but these are unlikely to be available in sufficient numbers to meet everyone's needs.

Some farms could struggle to access sufficient water to meet the recommended dilution rate of 1 milk to 10 water; this is identified as a potential issue for large farms in some parts of the Waikato. Even smaller farms taking their shed wash-down water supplies within a 50 m^3/d permitted activity limit may not have ready access to the volumes of water needed for adequate dilution. The repeated application of diluted milk to the same paddocks has the potential to clog soil pore spaces with fats, leading to retention of milk at the surface, and after a few days the onset of anaerobic conditions leading to offensive and objectionable odours, and a deterioration of soil productivity.

Limits: Assuming that the necessary infrastructure is available, there are two key limiting factors;

- The capacity of the soil to take up milk without being damaged; and
- The extent to which the application of milk will cause unacceptable odours.

For a typical effluent application a healthy soil can be expected to handle 600 kg BOD/ha/day. However, due to the composition of milk as described in Section 7.1 below, the breakdown of fats is slower than for effluent, so a lower application rate should be utilised. It is important to withhold any repeat application of milk to a site until the fats from the previous application have been degraded. An organic load of 2,000 kg BOD/ha is considered to be adequately degraded over a 16 to 20 day period. This corresponds to an application of approximately 20 m^3 milk/ha (2 mm application depth) on a rotation of 20 days. A dilution factor of 1 to 10 as recommended by Regional Councils would then result in an application depth of 22 mm, which is readily able to be achieved by most irrigation systems, without overloading the soil's capacity to safely attenuate the milk.

The practical implications of this rate of milk application for the New Zealand average sized herd[1] would be as follows. The daily 5.5 m^3 of milk would need 55 m^3 of water to be added,

[1] Average sized herd is 386 cows with a normal daily production of 5.5 m^3/d (varying between a spring peak of 7.7 m^3/d and an autumn low of 4.7 m^3/d) on 140 ha of land.

with the resultant 60.5 m^3 of fluid applied at a depth not exceeding 22 mm over an area of not less than 0.3 ha. No repeat applications should occur for at least 20 days, meaning that continued milk discharge to land could be sustained over an area of not less than 6 ha on this average sized dairy farm. This regime of milk discharge could be expected to generate a "musty" odour, but not an offensive or objectionable odour; and if the application is managed appropriately the impact on soil and water should be no more than minor.

Obligations: The discharge of milk to land, in situations where contamination may not enter either surface water or groundwater, does not require a resource consent unless a regional council specifies this requirement in a regional plan.

Similarly, an odorous discharge to the air, if the milk goes rancid, does not require a resource consent provided no national environmental standard or rule in a regional plan is breached, and generally provided that no offensive or objectionable odour is detected beyond the property boundary.

Thus the irrigation of milk onto pasture will not require specific authorisation, provided water bodies are not contaminated, and provided the odour does not become objectionable and offensive beyond the property. Only if there is a risk of, or actual, discharge of milk into a water body or the generation of objectionable and offensive odours will there be a requirement for authorisation as specified by s15 of the Resource Management Act 1991 (RMA).

Promotional: This option is promoted in the advisory information provided by several regional councils. Taranaki Regional Council recommends a 1 to 1 dilution rate, while all other councils addressing this issue recommend a dilution rate of 10 parts water to 1 part milk.

Conclusion: A good option for farmers who have access to the equipment required. Soil clogging and objectionable odours should be expected if land receives too high a rate of milk application, or repeat applications too frequently.

5.2.5 Option 5 – Discharge the Milk into the Farm Dairy Effluent System

Explanation: The milk is discharged into the pond that receives wash down effluent from the milking shed. Effluent and milk are then discharged, either to water or to land, as regulated by the regional council. This method assumes that the ponds are adequately sized for the existing herd (C. Rutherford, Fonterra Environment Programme Manager, personal communication, July 2012). It is possible to reduce the milk solids content prior to discharge to ponds. Organic acids can be added to increase separation. Solids must then be managed by alternative means (DEC, 2006).

Advantages: Convenient, doesn't require any equipment beyond what is already in place, except if solid separation is used. Discharge is already consented or permitted as required, albeit usually without specific provision for the inclusion of milk. Good for a short term emergency solution in most regions, and in most cases.

Disadvantages: Milk can disrupt the biological functioning of an effluent pond, leading to both the effluent discharge quality and the odour failing to meet consented or planned limits. Where effluent pond discharge is to water (see under Disadvantages in Option 4 above) there is the real prospect of milk showing up in that water. After about 4 to 6 milkings, the pond will be very

milky, and will be starting to exude potentially bothersome aromas as the highly degradable milk becomes rancid.

Limits: The two key limiting factors are:

- The odours that will develop in the effluent pond after a few days; and
- The ability to discharge the effluent/milk mix to meet regulatory requirements will be compromised after a few days.

Regional council staff consider four, and up to about six, milkings are able to be discharged into an effluent pond before odours become offensive. After this time there will be an increasing risk of public complaint about the odour, triggering a requirement for regional council enforcement action. Even with normal effluent discharge from the pond, the concentration of milk in the effluent will increase as more milk is added, although this will depend on the size of the pond and how full it is. A concentration of insoluble fats may develop at the pond surface, with the likelihood of rancid butter type aromas over time. In this case mechanical removal and treatment out of pond of this material (e.g. liming) may be required followed by alternative discharge of the treated solid material.

Within a farm dairy effluent pond, the normal daily intake comprises about 50 L of water per cow, and about 0.24 kg of raw excreta. If milk is being discharged into this same pond, that will add about 14 L of milk per cow per day, being about 20 % of the daily inflow.

An average sized dairy farm with a herd of 386 cows will have a normal daily farm dairy effluent production of 19.3 m^3, and if its farm dairy effluent pond system has a nominal one month's capacity, plus an allowance for feed-pad and silage storage run-off, the pond's volume will be in the order of 700 m^3. While the first day's milk discharge into such a pond, if it is already half full of farm dairy effluent, will lead to a milk dilution rate in the farm dairy effluent of only 0.014 or 1 in 70, that dilution rate will decrease (i.e. the milk concentration will increase) by that same amount for every day that the discharge continues. After one week, for example, the dilution rate will have reduced to 0.1 or 1 in 10. The concentration of milk will, of course, be much higher if the effluent pond is empty at the start of the discharge.

As well as the onset of objectionable odours from the pond, after about 4 to 6 days of milk discharge, the decay of the milk in the pond will have significantly changed the microbe flora and fauna in the pond as a result of the severe depletion of dissolved oxygen. This in turn will cause the farm dairy effluent and the milk in the pond to become anaerobic, resulting in intense and offensive odours being produced, not only from the milk but from the excreta too. Further, when the time comes for the combined farm dairy effluent and milk mix to be discharged from the pond, whether it be the preferred land application system or the stream discharges that a few regional councils still allow, the chemical condition of the mix is unlikely to meet the conditional limits imposed by the resource consent or rules applicable.

In summary, discharging of milk into the farm's dairy effluent pond system can be acceptable for the first few days, but by consensus among involved regional council staff, after 4 to 6 milkings both odours and the suitability of the farm dairy effluent for subsequent discharge become a source for significant environmental concern.

Obligations: The discharges from farm dairy effluent ponds are regulated by all regional councils, whether as permitted activities with specified performance standards, as controlled activities, or as discretionary activities. While most plans and consents for farm dairy effluent discharge do not specifically provide for the inclusion of milk, appropriate discharge to land of the combined product at a rate within consented limits will be accepted as good practice by

most regional councils under emergency conditions. Regional councils will not seek consent applications from, or apply other regulatory pressure to, farmers who are doing their best to deal with a difficult situation that is not of their own making.

Promotional: Discharging milk into the farm dairy effluent system is promoted by Fonterra and by most regional councils as one of the more acceptable options available if milk has to be disposed of. Northland Regional Council prefers other options because of the potential for ecological damage to waterways and estuaries from the half of the region's dairy farms that still discharge their farm dairy effluent to water.

Conclusion: A good option for a short term emergency, particularly where the subsequent treated farm dairy effluent discharge is to land. Odour generation and disruption of the pond's biological processes make this option unsuitable for a discharge that lasts beyond 4 to 6 milkings.

5.2.6 Option 6 – Bury the Milk in an Excavated Trench

Explanation: A trench is cut at a suitable on-farm location, as far as possible from any waterway; milk is carted to, and poured into, the excavation. Some of the excavated earth is replaced on top of the milk to prevent the development of odours.

Advantages: With the possible exception of carting the milk, this option uses equipment that most farms have. It gets rid of the milk, and it prevents the development of odours more certainly than any other option, provided burial is effective. It is an attractive option in such regions as Northland, where tight subsoil clays will protect underlying groundwater from contamination by the discharged milk.

Disadvantages: Pollution of both surface water and groundwater by discharged milk are risks where farms are located on floodplains, or on highly permeable volcanic ash, pumice, sand or gravel soils. If covering is not prompt, the odour from several days' discharge into a trench with limited seepage could become a nuisance for down-wind neighbours and passers-by.

Liquid milk may soak through the subsoil to contaminate groundwater, and/or rise to the surface to generate odours and run off to contaminate surface water. In order to reduce this problem, organic acid can be added to milk in a suitable trough or vat, to cause the milk to curdle. The resultant liquid, which is essentially whey, can then be discharged to the farm effluent system, with the clotted solid being buried in the trench. (DEC, 2006, section 1.6.3).

Limits: The limiting factors here are the risk of pollution of groundwater if subsoil permeability is too high, and the risk of surface ponding, run-off to surface water, and odours if the subsoil permeability is too low.

Obligations: Provided the burial can be conducted in such a way as to prevent any contamination of surface water or groundwater, this option does not require authorisation as specified by s15 of the RMA. However, as noted above, there are risks of contamination to groundwater in particular in many areas of the North Island, and advice on whether or not to use this option should be sought from, and/or provided by, regional councils. Odour could become a legal issue if burial is not effective, as could seepage into water if the discharge is in an unsuitable site.

Promotional: Most regional councils include this option in their promotional and advisory material. Northland Regional Council promotes this approach, but Waikato Regional Council prefers farm dairy effluent pond or irrigation because of the risk of contamination of both surface water and groundwater.

Conclusion: A good option where the risk of contamination of surface water and ground water can be effectively avoided. A good option for the avoidance of objectionable odours, provided burial is prompt and effective. Generally more favourably regarded in Northland than in any other North Island region. Not favoured in the Taranaki and Waikato regions due to the likelihood of contamination of water bodies.

5.2.7 Specific Conclusions

Direct responses to the questions posed in Item 1 of the Terms of Reference (Appendix 1) are as follows;

- Section 5.2 of this report has addressed the methods available to farmers for disposing of raw milk. These are to send the milk elsewhere, to discharge it to a waterway, to feed it to livestock, to irrigate it to pasture, to put it through the farm's farm dairy effluent system, or to bury it. Discussion on the limitations to and appropriateness of these options is provided. Milk production can be reduced, but a resumption of full production could be delayed, and there will still be milk to be disposed of.
- Milk is only discharged on farms as a last resort, representing as it does a direct loss of farm income without any off-setting reduction in farm costs. In a typical year no milk is disposed of. Comparatively small volumes (up to a few dozen cubic metres) can be discharged in the event of a road accident with a tanker, or of infrastructural failures on individual farms. In such instances the clean-up and/or return to normal milk collection is achieved in the shortest possible time, and seldom more than a few days. The large requirements for milk disposal across several districts, such as those caused by gas supply outages or equivalent major disruptions of other public infrastructure (eg floods, earthquake, electric power outage, or industrial action), are occasional, infrequent and variable in nature. Characterisation of these events is difficult and combined with the likely frequency and duration of any need for disposal makes the establishment of alternative disposal infrastructure difficult. The environmental consequences that set large-scale milk disposal apart from random small events are the cumulative threat to water quality and the cumulative generation of offensive odours. These cumulative effects will be greater than the sum of the individual on-farm events.
- It is noted that about half the dairy farms in Northland and Taranaki, and about 10% of those in the Waikato, still discharge their farm dairy effluent to water. Most of these will not have irrigation equipment that could be used to apply diluted milk to pasture. In these cases the use of the effluent system for milk disposal may be a farmer's only viable option. The discharge of this effluent to water puts the areas involved at high risk of significant adverse environmental effects if there is a prolonged period without milk collection.
- It should be noted that while there are a number of alternative options potentially available to farmers for the alternative disposal of milk, in many cases only one or two of these will be practicable for reasons of infrastructure, soil type, timing, or location.

Direct responses to the questions posed in Item 2 of the Terms of Reference (Appendix 1) are as follows;

- Off-farm milk disposal is addressed in subsection 5.2.1 above, involving sending the milk somewhere else. While this may be a viable option for a small number of well-motivated and well-connected individual farmers, it is not a viable option for the numbers of farmers, or the daily volume of milk, that would be affected by a significant gas supply outage. The requirement to cope with large scale disposal is so spasmodic and unpredictable that purpose-built milk storage, treatment and disposal facilities could not be economically justified at a farm level. However, there are options to utilise, in some cases in a limited capacity, existing farm infrastructure. Discharge of milk to municipal wastewater treatment facilities would quickly overwhelm their biological capacity and this does not present an option worth further consideration.
- Off-farm milk disposal can potentially include the re-routing of milk to an alternative processing plant that is not affected by whatever incident has closed the plant normally used. It may be expected that the dairy companies will use their best endeavours to take this approach wherever possible, in order to preserve the value of the commodity involved. However, it must be noted that while this option could be feasible outside the peak of the season, it will generally not be an option during the peak season when all plants will be running to full capacity.

6.0 RMA REGULATORY REQUIREMENTS

6.1 Relevant Sections of the Resource Management Act

The following sections of the act have a bearing on the discharge of raw milk.

6.1.1 Section 15 - Discharge of contaminants into environment

(1) No person may discharge any—

(a) contaminant or water into water; or

(b) contaminant onto or into land in circumstances which may result in that contaminant (or any other contaminant emanating as a result of natural processes from that contaminant) entering water; or (…)

unless the discharge is expressly allowed by a national environmental standard or other regulations, a rule in a regional plan as well as a rule in a proposed regional plan for the same region (if there is one), or a resource consent.

(2) No person may discharge a contaminant into the air, or into or onto land, from a place or any other source, whether moveable or not, in a manner that contravenes a national environmental standard unless the discharge—

(a) is expressly allowed by other regulations; or

(b) is expressly allowed by a resource consent; or

(c) is an activity allowed by section 20A.

(2A) No person may discharge a contaminant into the air, or into or onto land, from a place or any other source, whether moveable or not, in a manner that contravenes a regional rule unless the discharge—

(a) is expressly allowed by a national environmental standard or other regulations; or

(b) is expressly allowed by a resource consent; or

(c) is an activity allowed by section 20A. (…)

6.1.2 Section 17 – Duty to avoid, remedy, or mitigate adverse effects

(1) Every person has a duty to avoid, remedy, or mitigate any adverse effect on the environment arising from an activity carried on by or on behalf of the person, whether or not the activity is carried on in accordance with—

(a) any of sections 10, 10A, 10B, and 20A; or

(b) a national environmental standard, a rule, a resource consent, or a designation.

(2) The duty referred to in subsection (1) is not of itself enforceable against any person, and no person is liable to any other person for a breach of that duty.

(3) Notwithstanding subsection (2), an enforcement order or abatement notice may be made or served under Part 12 to—

(a) require a person to cease, or prohibit a person from commencing, anything that, in the opinion of the Environment Court or an enforcement officer, is or is likely to be noxious, dangerous, offensive, or objectionable to such an extent that it has or is likely to have an adverse effect on the environment; or
(b) require a person to do something that, in the opinion of the Environment Court or an enforcement officer, is necessary in order to avoid, remedy, or mitigate any actual or likely adverse effect on the environment caused by, or on behalf of, that person.

(4) Subsection (3) is subject to section 319(2) (which specifies when an Environment Court shall not make an enforcement order).

6.1.3 Section 18 – Possible defence in cases of emergency

(1) Any person who is prosecuted under section 338 for an offence arising from any contravention of any of sections 9, 11, 12, 13, 14, 15, 15A, and 15B may raise any applicable defence that is referred to in section 341 or section 341A or section 341B.

(2) No person may be prosecuted for acting in accordance with section 330 (which relates to certain activities undertaken in an emergency).

6.1.4 Section 330 – Emergency works and power to take preventive or remedial action

Where—
(a) any public work for which any person has financial responsibility; or
(b) any natural and physical resource or area for which a local authority or consent authority has jurisdiction under this Act; or
(c) any project or work or network utility operation for which any network utility operator is approved as a requiring authority under section 167—
is, in the opinion of the person or the authority or the network utility operator, affected by or likely to be affected by—
(d) an adverse effect on the environment which requires immediate preventive measures; or
(e) an adverse effect on the environment which requires immediate remedial measures; or
(f) any sudden event causing or likely to cause loss of life, injury, or serious damage to property—
the provisions of sections 9, 12, 13, 14, and 15 shall not apply to any activity undertaken by or on behalf of that person, authority, or network utility operator to remove the cause of, or mitigate any actual or likely adverse effect of, the emergency.

(1A) Subsection (1) applies whether or not the adverse effect or sudden event was foreseeable.

(2) Where a local authority or consent authority—
(a) has financial responsibility for any public work; or

(b) has jurisdiction under this Act in respect of any natural and physical resource or area—

which is, in the reasonable opinion of that local authority or consent authority, likely to be affected by any of the conditions described in paragraphs (d) to (f) of subsection (1), the local authority or consent authority by its employees or agents may, without prior notice, enter any place (including a dwellinghouse when accompanied by a constable) and may take such action, or direct the occupier to take such action, as is immediately necessary and sufficient to remove the cause of, or mitigate any actual or likely adverse effect of, the emergency.

(2A) Sections 9, 12, 13, 14, and 15 do not apply to any action taken under subsection (2).

(3) As soon as practicable after entering any place under this section, every person must identify himself or herself and inform the occupier of the place of the entry and the reasons for it.

(4) Nothing in this section shall authorise any person to do anything in relation to an emergency involving a marine oil spill or suspected marine oil spill within the meaning of section 281 of the Maritime Transport Act 1994.

6.1.5 Section 330A – Resource consents for emergency works

(1) Where an activity is undertaken under section 330, the person (other than the occupier), authority, or network utility operator who or which undertook the activity shall advise the appropriate consent authority, within 7 days, that the activity has been undertaken.

(2) Where such an activity, but for section 330, contravenes any of sections 9, 12, 13, 14, and 15 and the adverse effects of the activity continue, then the person (other than the occupier), authority, or network utility operator who or which undertook the activity shall apply in writing to the appropriate consent authority for any necessary resource consents required in respect of the activity within 20 working days of the notification under subsection (1).

(3) If the application is made within the time stated in subsection (2), the activity may continue until the application for a resource consent and any appeals have been finally determined.

6.1.6 Section 341 – Strict liability and defences

(1) In any prosecution for an offence of contravening or permitting a contravention of any of sections 9, 11, 12, 13, 14, and 15, it is not necessary to prove that the defendant intended to commit the offence.

(2) Subject to subsection (3), it is a defence to prosecution of the kind referred to in subsection (1), if the defendant proves—

(a) that—

(i) the action or event to which the prosecution relates was necessary for the purposes of saving or protecting life or health, or preventing serious damage to property or avoiding an actual or likely adverse effect on the environment; and
(ii) the conduct of the defendant was reasonable in the circumstances; and
(iii) the effects of the action or event were adequately mitigated or remedied by the defendant after it occurred; or

(b) that the action or event to which the prosecution relates was due to an event beyond the control of the defendant, including natural disaster, mechanical failure, or sabotage, and in each case—
(i) the action or event could not reasonably have been foreseen or been provided against by the defendant; and
(ii) the effects of the action or event were adequately mitigated or remedied by the defendant after it occurred.

(3) Except with the leave of the court, subsection (2) does not apply unless, within 7 days after the service of the summons or within such further time as the court may allow, the defendant delivers to the prosecutor a written notice—
(a) stating that he or she intends to rely on subsection (2); and
(b) specifying the facts that support his or her reliance on subsection (2).

6.2 Interpretation and Applicability to Milk Disposal

The presumption of s15(1) is restrictive, and all discharges of milk to water, or onto land in a way that milk **may** enter water, must be authorised by a national environmental standard, or by a rule in a regional plan, or by a resource consent. If there is little likelihood of contaminants entering water, then the discharge would be allowed unless the regional council has specifically restricted it. No national environmental standard, and no regional rule, authorises a discharge of milk to water. A resource consent for such a discharge would not normally be granted.

The presumption of s15(2) and s15(2A) is permissive, and discharges of contaminants to air are permitted unless they contravene a national environmental standard, some other regulation, or a regional rule. These sections relate to the odour potentially generated as a result of discharging milk, which is only restricted if a rule or regulation specifically restricts it. Regional plans and resource consents that address activities that may give rise to odours, including the discharge of farm dairy effluent, specify that no odour that is offensive and objectionable beyond the originating property boundary is authorised. Even if a regional plan does not restrict the emission of odours, the provisions of s17 effectively disallow an objectionable or offensive odour.

s17 provides that while all persons have a duty to avoid, remedy or mitigate adverse environmental effects, the enforcement of this requirement is only possible through the issue of an abatement notice or an enforcement order. The only applicability of this provision to milk discharge is where a farmer has contravened a regional plan rule, not

complied with a consent condition or ignored or disobeyed regional council advice in such a way as to cause an unacceptably adverse and avoidable environmental effect. For example, if an objectionable and offensive odour is being generated, this section authorises the use of enforcement proceedings against the persons responsible.

s18 provides for a farmer discharging milk in contravention of the provisions of s15, to have a defence against prosecution if the circumstances of the milk discharge are provided for in s330 or s341, as described below.

s330 applies to the discharge of milk only to the extent that it authorises a regional council to intervene and undertake works to remediate the adverse effects of the discharge, where the adverse effects are sufficiently severe to warrant such a measure, and/or where the farmer involved refuses to do so. This section does not directly apply to a dairy farmer discharging milk.

s330A provides for the regional council to seek formal authorisation by way of resource consent, if necessary, for work that is occasioned by the application of s330 above.

s341 provides a defence for a farmer discharging milk in breach of a plan or consent requirement, provided he follows the advisory and promotional material provided by his milk processing company and/or regional council, and can demonstrate that the discharge was caused by issues beyond his/her control (eg a gas outage) and that s/he took all reasonable steps to minimise adverse environmental effects.

In summary;

- The discharge of milk into or near water is not allowed.
- Odours arising from discharged milk are not allowed to be offensive or objectionable beyond the originating property boundary.
- Regional councils have several legal mechanisms to cause milk discharges to be undertaken in such a way as to minimise adverse environmental effects, including requiring the farmer to do so, and undertaking the required measures themselves if a farmer fails to do so.
- Advice from regional councils indicates that a farmer discharging milk in breach of a plan or consent requirement will not be prosecuted, or will have a defence against prosecution, if s/he can show that the milk discharge was unavoidably caused by issues outside her/his control, that s/he has diligently followed the advisory and promotional material provided by her/his milk company and/or the regional council, and that all reasonable steps have been taken to minimise environmental damage.

6.3 Regional Council Approaches to Milk Disposal

Advice was not sought from the Gisborne unitary council as to its approach to milk disposal, due to the smallness of dairy production in that district in the context of the North Island as a whole.

All (other) North Island regional councils provided verbal advice on the approach they take to milk disposal, and copies of promotional and advisory material, where available. An example of such information is presented in Appendix II from Auckland Council. Councils typically take what should be regarded as a constructive and pragmatic approach to milk disposal, recognising that

milk discharge only occurs as a result of failure of the supply chain beyond the farmer's control. All regional councils provide advice to farmers on the steps they should take to minimise the adverse environmental effects of discharging milk, either by the provision of simple brochures that are kept in stock or on-line, and/or by press and broadcast media releases of equivalent advice. There is close interaction between these regional councils and Fonterra to ensure the timely presentation of relevant advice to affected farmers in these circumstances.

Some councils have comparatively new advisory information available (e.g. Northland, Bay of Plenty, Taranaki), others have more elderly (but still entirely relevant) information (e.g. Wellington) while others do not have standard information, but provide support to the dairy companies in their own provision of such advice, and provide *ad hoc* news releases as may be appropriate in the circumstances (eg Hawke's Bay, Horizons, and Waikato).

The available advisory information is mostly consistent, except where there are physical differences between regions that warrant different handling of milk discharges. Northland is the stand-out region in this regard, where tight clay subsoils and small, sensitive catchments make milk burial in trenches as far as possible from waterways a workable option. Other regions, on the other hand, have a greater potential for contamination of groundwater from milk burial, so they prefer dilution and irrigation. While Northland does not favour discharge to effluent ponds because of the water contamination risk, several other regional councils and Fonterra consider this a good option. For irrigation, Taranaki recommends 1:1 dilution of discharged milk with water, while the other regional councils specify a dilution rate of 1 milk to 10 water.

It should be noted here that about 50% of the dairy farms in Taranaki and Northland, and about 10% of those in the Waikato, currently discharge their farm dairy effluent to water, and that most of these will not have equipment capable of irrigating milk onto pasture. With the effluent system being their only practicable option for milk disposal, these areas will be at the highest risk of environmental damage if farmers are required to discharge milk for more than 4 to 6 milkings.

The differences between the approaches of the regional councils are not considered to be a source of any confusion or misunderstanding. As long as farmers follow the recommendations of **their** regional council, they will not be subject to any enforcement action by that council.

On the issue of resource consents for milk discharge, although such consents are clearly envisaged in s15 and s330A where contamination may reach water, all North Island regional councils take the pragmatic approach that there is generally nothing useful to be achieved by pursuing this requirement. It may be assumed that farmers will only discharge milk as a result of issues beyond their control, and will resume sending their milk to the processing plant as soon as possible. Provided farmers have generally followed the advice of their dairy company and/or their regional council to minimise adverse environmental effects, regional councils do not expect farmers to apply for retrospective resource consents to authorise their discharges.

6.4 Specific Conclusions

Direct responses to the questions posed in Item 4 of the Terms of Reference (Appendix 1) are as follows;

- The requirements for resource consents or other regulatory requirements for milk discharge are addressed in section 6 of this report. Resource consents are not needed for a milk discharge that does not contaminate water, and does not generate offensive

and objectionable odours beyond the property boundary. Resource consents are not required by any North Island regional council for milk discharge arising from a supply chain failure, such as a gas fuel supply disruption, that is a beyond a farmer's control. s341 of the Act provides a defence against prosecution for any farmer discharging milk who follows the advisory information and recommendations of her/his dairy company and/or regional council. North Island regional councils currently do not require approvals for such milk discharge events, and there are no associated reporting requirements for farmers.

- In the event that a requirement to dispose of milk lasts longer than 4 to 6 milkings, there is the real prospect of the propagation of odours that at least some members of the wider community will find objectionable and offensive. Northland Regional Council had this experience with a milk processing plant during and after the October 2011 gas supply outage; and their response was to assist, advise and support the plant to do what was practicable to minimise the nuisance. Nevertheless, in the event of the requirement for milk disposal becoming protracted, regional councils can be expected to come under pressure from their communities to "do something" about the smell, and it would be unwise to expect unlimited patience from the regional councils for continuing unauthorised discharges.

7.0 ENVIRONMENTAL EFFECTS OF DISCHARGING RAW MILK

7.1 Raw Milk Composition

Consideration of potential contaminants is important when assessing the potential for environmental impacts from discharging raw milk. The composition of milk can be broadly described as (Worsley (date unknown); NZIC, 2012):

- 86 % water;
- 5 % fat (lipids);
- 3 % protein;
- 5 % lactose (sugar); and
- 1 % minerals.

The environmental impact of each of these components depends on their biodegradability and, in water, their solubility. Because of the high organic content (fats, proteins and lactose are all organic compounds) the degradation of milk has a high requirement for oxygen which is measured as biochemical oxygen demand (BOD). At this point it should be noted for clarity that reference to organic content means the chemical composition and characteristics of the material (milk) and not the farming method by which it may have been produced.

The environmental implications of the high BOD are discussed in the sections that follow. By way of comparison, raw milk has a BOD in the range of 100,000 mg O/L while dairy shed effluent has BOD of 2,500-4,000 mg O/L (ARMC, 1999; Cooper and Morgan, 1982; Dairy Australia 2008). COD of milk is substantially higher at 250,000 mg O/L (J. Russell, Fonterra Environmental Technical Group Manager, personal communication, July 2012).

The form of the organic compounds also impacts on the manner in which they degrade and therefore the time and severity of the environmental impact. Raw milk comprises typically easy-to-degrade components, as compared to dairy shed effluent, which has organic matter dominated by slow-to-degrade plant and microbial cellular material.

The decay of raw milk involves several degradation processes. Lactose is readily degraded and so rapid oxygen depletion may occur, however the length of time of the effect may be short. On the other hand fats are typically much slower to degrade, so the impact of discharge of fats may be longer lasting. In addition the limited solubility of some milk components may concentrate the location of the effect i.e. by creating a "slick" on water or by coating soil.

The degradation of milk produces a complex mix of odorous compounds including ammonia, phenols, mercaptans, and sulphides (Mackie *et al.*, 1998). The most recognisable being butyric acid which gives the rancid smell associated with spoiled milk.

The following sub-sections discuss how the composition and degradation of raw milk impact on different receiving environments.

7.2 Effects on Surface Water and Aquatic Ecology

Ironically, while milk is one of nature's great foods, the results of discharging it into water can be ecologically catastrophic. With its high nutrient value, as milk decays it has an enormous

BOD, which strips the dissolved oxygen from surface water resulting in the demise of oxygen-requiring aquatic plants and animals.

In addition, introduction of milk into water causes unacceptable changes to the colour and turbidity of the water. This impacts the aesthetic value of the water. There is an ecological impact due to reduction in light penetration which negatively impacts the waterway health.

The supply of nutrients (nitrogen and phosphorus) and a carbon source encourages the growth of nuisance periphyton (aquatic plants) which competes for oxygen in the water and alters the habitat of the waterway by coating the stream bed or shading the waterway. The addition of lactose from milk is known to stimulate the growth of so called "sewage fungi" which are filamentous slimes in waterways (NZIC, 2012).

Other potential issues for water discharge of milk may occur due to changes in pH and temperature of a waterway. One of the packages of milk disposal advisory material from a regional council notes that milk is one thousand times more contaminating than the equivalent volume of farm dairy effluent.

Milk in surface water, whether directly discharged, running overland, or soaking through porous gravels, will produce a kill-off of fish including eels, and macroinvertebrates including insect larvae. These aquatic populations may take a long time to recover, long after the visible signs of milk contamination have washed out to sea.

It is because of the severity of this ecological damage that regional councils all take a firm view on the prohibition of discharging milk in such a way that it does, or may, enter any surface waterway.

7.3 Effects on Groundwater

Groundwater itself is not directly the habitat of oxygen-dependent organisms. Long passage of milk-contaminated water through the ground may reasonably be expected both to dilute, and to filter out, the fatty nutrient-rich milk constituents that are the source of potential concern at the surface. However, groundwater is normally a source of much of the flow in surface streams and rivers, and is also the source of the groundwater abstractions upon which many water supplies, including those of dairy farmers, depend.

If discharged milk contaminates groundwater in such a manner as to result in milky stream flows, or in milky water being taken up in bores, then the person discharging the milk will be considered to have caused an unacceptable discharge of contaminant into the environment. Further, once such a contaminating effect becomes apparent, it may be expected to take much longer to clear than would be the case with a surface stream. Groundwater replenishing stream flow or supplying water via a bore, once contaminated with milk, should be expected to remain so contaminated for an extended period of time after the discharge has finished, as the filtered material in the overlying soil is slowly released as it degrades. Stream flow or bore water takes that are contaminated as a result of milk discharges can be expected to remain unsuitable for either ecological or on-farm uses for a much longer time than just the duration of the discharge.

7.4 Effects on Soil

As with other receiving environments, soil is vulnerable to damage when managed inappropriately. In addition, when a discharge to soil is poorly planned or executed there will be flow-on effects to other environments being the air, surface water and groundwater. The application of wastes to soil relies on soil microbial activity and plant uptake to break down, degrade, attenuate and remove or make innocuous the applied material. Applying milk at a rate in excess of the soil's capacity to break it down will result in a number of effects, which are discussed below.

The depletion of oxygen corresponding to the BOD of the milk may cause anaerobic conditions in the soil. This leads to excessive growth of slimes which cause:

- production of undesirable odours;
- clogging of soil pores and soil surface;
- reduced soil infiltration capacity; and
- overland flow of water or applied waste.

The application of milk at a rate which exceeds the infiltration capacity and permeability of the soil will lead to ponding and overland flow of milk and resulting discharge to surface or groundwater, as well as further inducing anaerobic conditions in the soil.

The application of fats to the soil may cause formation of a film on soils and plants resulting in reduced ability for water to penetrate. These films are eventually broken down in a healthy soil. However, the break-down process itself leads to increased populations of some microbes which may have effects deemed to be undesirable. At rates equivalent to a 20 mm depth of milk application, soil in laboratory incubation was covered in white mycelial growth within 2-3 days and developed a "musty" odour (Cooper and Morgan, 1982). Not only is there the potential for the soil to be affected, but the same effects can have a negative impact on the soil's productivity, plant growth and palatability of crops grown in that soil.

Unlike for the other receiving environments described, it is likely that the above mentioned adverse effects can be avoided or remediated, or their duration can be minimised, with careful management. This is discussed further in Section 8.2 below.

7.5 Effects on Air Quality

Cool, fresh milk that has experienced limited exposure to air has a pleasant and generally acceptable odour, as any weetbix-eater or milkshake-drinker will attest. However, as milk decays in contact with air and sunshine over a period of a few days, the nature of the odour changes from pleasant and acceptable to rancid, sour, offensive and objectionable. Odours associated with the degradation of milk which may be deemed offensive include:

- 'Musty' odour due to mycelial and fungal growth in response to lactose application to the soil;
- 'Rancid' odour due to breakdown of fats to (amongst others) butyric acid;
- 'Effluent' odour due to mercaptans and other sulphurous compounds;
- 'Sour' odour due to bacterial degradation; and
- Ammonia smell due to protein breakdown.

It is this suite of off-odours from decaying milk that is the environmental effect of milk disposal that is most likely to draw complaints from neighbours, passers-by, and the general public. Regional councils cannot be expected to ignore, or be apologists for, a continuing odour that is offensive and objectionable. They are also duty bound to act to ensure nuisances do not continue.

Both land application and burial of milk that must be disposed of can be an effective method for limiting the extent of off-odours, provided it can be achieved without over-loading the soil's capacity to assimilate the milk, without seepage leading to contamination of groundwater, and without causing localised surface ponding or run-off.

8.0 CRITICALLY DEPENDENT TIMING AND EFFECTS

8.1 Advice of Suspension of Milk Collection

The first requirement for timeliness is the provision of advice to dairy farmers by their processing plant (or more likely their milk supply company) that, for whatever reason, milk will not be able to be collected. In the event of a gas supply outage forcing a stop to milk processing plant operation, the gas supply operator needs to provide advice of an interruption of gas supply to the affected milk processing plant(s) at the very earliest possible time. With hundreds, and in some cases thousands, of suppliers, milk processing plants and their controlling organisation will be faced with a logistical challenge in getting the earliest possible advice of suspension of milk collection out to farmers.

Timeliness of this advice to farmers will be crucial to enable re-deployments of labour, infrastructure, and cows in an orderly manner. While all dairy farmers are made aware by their dairy company of the need for contingency planning for possible disruptions to milk collection, nevertheless it will usually take at least a few hours for each farmer to make the necessary arrangements to discharge or otherwise dispose of his uncollectable milk. These arrangements will also be dependent, at least initially, on the expected duration of any outage.

Because raw milk has only a short shelf-life, milk storage capacity on farms is normally limited to only one day's production. Dairy farmers do not have the luxury of putting continuing milk production into storage, and waiting to see when the tanker collections will resume. Arrangements to discharge will normally need to be made almost immediately, with the exception being at the start and end of the milking season when the daily volume will be less and some storage carryover can be used.

8.2 Time for Odours to Develop and Management of Soil Health

Discharged milk will start to "go off" quickly in contact with air in warm, sunlit conditions, unless it is spread over the soil in such a manner as the soil organisms are able to degrade the milk. The odour from milk applied to the land too thickly may become offensive within two or three days.

If the milk is applied at a sufficiently low rate to land, with a sufficiently high rate of dilution with water, then the milk can be expected to decay and odour generation to cease before those odours have reached an unacceptable intensity. Provided the irrigation of diluted milk onto land is able to move from paddock to paddock in such a way that a repeat application over any area of land does not occur before the applied milk has completely broken down, then there should be only a "musty" odour which is no more intense or objectionable than normal dairy farming odours.

In summary, irrigation of diluted milk onto pasture is considered capable of taking a dairy farm's entire production of milk, provided the application rate is kept sufficiently low, and the rotation of irrigation around the farm is sufficiently long.

Discharging of milk into the farm's dairy effluent pond system can be acceptable for the first few days, but by consensus among involved regional council staff, after 4 to 6 days both odours and the suitability of the farm dairy effluent for subsequent discharge become a source for significant environmental concern.

9.0 CONCLUSIONS

9.1 Milk Production

The 8,947 dairy herds in the North Island produce about 39,000 m^3 of raw milk per day during an annual season of about 270 days. The breakdown of this production into districts and regions is tabulated in Table 1.

The average dairy farm in New Zealand occupies 140 ha, has a herd of 386 cows, and produces an average of 5.5 m^3 of milk per milking day.

9.2 Dependency on Gas Fuel

While few, if any, dairy farms depend directly on gas fuel for their operation, most North Island dairy processing plants are at least partly dependent on gas fuel for their operation. Disruption of gas supply has a major effect on North Island milk processing capacity.

9.3 Farm Contingency Measures

Unless cows are to be dried off until the following season, any disruption of milk processing plants means that continued milk harvesting will require disposal of milk until the processing plant can resume its function.

Of the available methods for disposing of raw milk on dairy farms, sending the milk elsewhere and feeding the milk back to the cows have very limited applicability, and discharging the milk to water is simply not an option.

Burial is possible, but with risks of either seepage to groundwater if the soil is porous, or of surface ponding if the soil is insufficiently porous. Northland is the one North Island region where, for several good reasons, milk burial is regarded as a good option.

Discharge into the farm's dairy effluent system is a workable option for up to 4 or 6 milkings, and involves the use of infrastructure that is already present on all dairy farms. However, beyond this time both the odour and the biological functioning of the farm dairy effluent pond will be compromised, with unacceptable environmental consequences. In Taranaki and Northland, and to a lesser extent in the Waikato, significant numbers of dairy farms still discharge their effluent to water. Because the farms involved mostly do not have irrigation equipment, discharged milk will eventually enter water, and it is these areas that are at the highest risk of pollution of water bodies if milk discharge is required.

Irrigation of milk onto pasture, with a dilution of 1 part milk to 10 parts water, and an application depth of not more than 22 mm, can be sustained for as long as may be needed on most dairy farms, provided the required infrastructure can be deployed. This option will avoid both unacceptable odours and damage to the soil and its productive capability.

9.4 Resource Management Act Requirements

All North Island regional councils recognise that the discharge of milk on dairy farms can result from such a major contingency as a gas fuel outage. Councils have indicated that, provided the promotional and advisory information provided by the councils (such as that in Appendix II) and the relevant milk company are followed, and adverse environmental effects of the discharge are managed to the extent practicable, they are unlikely to take enforcement action against farmers who may inadvertently breach the RMA. There is no reporting requirement to the regional councils, and s341 of the RMA provides a defence against prosecution for any farmer showing that the promotional and advisory information provided has been followed diligently.

9.5 Environmental Effects

Discharged milk can seriously damage aquatic ecosystems, can disrupt the biological functioning of effluent ponds and the soil, and can develop offensive and objectionable odours. Discharge of milk to water is to be avoided in all circumstances. Damage to the biological functioning of effluent ponds may be limited if the discharge is not for longer than about 4 days. Damage to the soil can be avoided by a combination of adequate dilution of the milk and use of a sufficiently large application area, without re-applications to any site for at least 20 days. Odours can be kept tolerable by an appropriate land application method, by ensuring that buried milk stays buried, or by limiting the period of the discharge into an effluent pond to no longer than about 4 days.

In conclusion, the economic effects of any wide-spread requirement to dispose of milk are very serious, and the pollution of water, damage to soil, and release of odours can also be serious. However, there is a range of milk disposal options available to farmers to reduce the environmental effects to levels that may be considered acceptable. Discharge of milk to the farm effluent system is a practicable option on all farms, although serious problems can arise if the discharge has to continue for longer than about 4 days. Irrigation of the milk to pasture can be sustained over a long period, although some farms will not have the infrastructure available to use this option, especially when the requirement to dispose of milk will normally come without warning.

10.0 REFERENCES

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11.0 APPENDICES

APPENDIX I

GICL Terms of Reference

Terms of reference: Review of methods for and impacts of raw milk disposal

Report requirements

As a means of assisting us to consider the issues regarding criteria for essential service provider designations, Gas Industry Co requires an independent report on the issue of raw milk disposal. The report should collate and synthesise the current scientific understanding on milk disposal methods, as well as their relative merits and limitations. Specifically, the report should include:

1. A review of on-farm methods for disposing of raw milk, including a discussion of whether some methods are more appropriate to some situations (perhaps related to weather, paddock condition, or other factor), and why; any limitations of those methods; and, if available, how often these methods are used in a typical year, and for what volumes;
2. A review of any off-farm methods of disposing of raw milk, their applications, limitations, and, if available, frequency of use;
3. A review of possible environmental effects that could arise from the disposal of raw milk, including an outline of the possible short- and long-term damage to pasture or farm infrastructure; the frequency or volume of milk disposal that would be associated with those effects, and the steps that could be taken to mitigate those adverse effects;
4. An overview of the regulatory requirements that would need to be satisfied for on-farm milk disposal (for example, do farmers need resource consent? Would they have a standing consent, or would they need to get approval for each event? Are there any reporting requirements associated with milk disposal?); and
5. An assessment of how much milk is produced in a typical year, by week and by region; and an estimate of how much milk could feasibly be disposed of on farms in a peak week.

Where appropriate, the report should cite the sources and published research used in the development of the report.

APPENDIX II

Auckland Council Contingency Management

Following the major disruption to the gas pipeline supply network to the upper North Island, emergency disposal of milk may be required over the coming days.

The Auckland Council has created the following guidance on the disposal of this milk.

1. Irrigation of waste milk to land is the preferred option of disposal
    - Irrigate to land at a dilution of 1:10 with water to avoid damage to pasture
    - Where possible, irrigate onto recently grazed pasture
    - Flush the pasture with clean water to rinse the milk residues from foliage into the soil following irrigation (this will also help to reduce odour). But do not over flush the pasture so that the milk washes into waterways.
    - Use as much land area as practically possible and do not apply more than 50,000L/Ha or 5L/m2
    - If possible, use land that can be worked following application
    - Monitor the application of milk to ensure that there is no discharge to water bodies. There should be at least a 20 metre separation between the application area and a waterbody and a 100 metre separation distance from water supply bores. Actual distance will vary according to site specific conditions and weather.
    - Prevent ponding of milk, wastewater and overland flow into waterways, including drains, when irrigating
    - Try to avoid irrigating near property boundaries to minimise odour potential

2. Disposal to on-site oxidation ponds (2 pond systems that discharge) should be used as a last resort. These ponds should receive no more than 4 milkings before other options such as land application are used. Fonterra may be able to assist in providing advice on other options such as collection and disposal off-site.

3. **Under no circumstances should milk be allowed to enter waterways.**

If you need any more information, please contact Auckland Council's Team Leader Rural and Wastewater Tony Bullard on 09 353 9557.